

Approved For Release 2001/08/27 : CIA-RDP79-00798A000300070006-2
UNIVERSITY OF CALIFORNIA LOS ANGELES

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SANTA BARBARA • SANTA CRUZ



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WJ STATINTL
MATERIALS DEPARTMENT
SCHOOL OF ENGINEERING AND APPLIED SCIENCE
LOS ANGELES, CALIFORNIA 90024
6532 Boelter Hall

December 5, 1975

Revisions

TO: Dr. Russell Hill, Airco Temescal, Berkeley
Dr. Erwin Rudy, Oregon Graduate Center, Portland
Mr. Robert A. Beall, U.S. Bureau of Mines, Albany
Dr. Hugh Smith, Industrial Vacuum Engineering, San Mateo
Dr. Troy Barbee, Jr., Stanford University, Stanford
Dr. Larry Kaufmann, Manlabs, Inc., Cambridge
Mr. Michael Field, Metcut Associates, Cincinnati
Dr. Law McCabe, Teledyne Firth Stirling, Pittsburgh
Dr. Hal Brody, University of Pittsburgh, Pittsburgh
Dr. Richard Heckel, Carnegie-Mellon University, Pittsburgh

RE: Soviet Visitors

Gentlemen:

As I had informed some of you, the visit of the Soviet delegation was postponed by one week. For least confusion, we have inverted the order of their visits between the East and West Coasts. The order and dates for visits to the East Coast- Cambridge, Cincinnati, Pittsburgh remain the same and on the same dates. The order and dates of visits on the West Coast are somewhat modified- Los Angeles-San Francisco-Portland and directly to New York. The revised schedule is attached.

Again, my sincere thanks for all your efforts.

Sincerely yours,

R.F.Bunshah

R. F. Bunshah, Chairman
Task Force on Electron Beam Evaporation

RFB:dd
Enclosure

cc: N. Promisel,
R. Wasilewski,
W. Root
E. VanEcho
A. Sheldon

State Dept. declassification & release instructions on file

Electron Beam Evaporation

REVISED ITENARY FOR VISIT OF USSR DELEGATION - TASK FORCE ELECTRON BEAM
EVAPORATION

Visitors are: Prof. B.A. Movchan, Dr. A.V. Demchishin, Dr. L.V. Kovalchuk, Paton Welding Institute, Kiev; Dr. V.N. Andreev, All Union Scientific Research Instrumental Institute; and Mr. S.N. Glebov, State Committee on Science and Technology. Airline reservations have been made and confirmed for flights in the U.S. We expect that Mr. Alexis B. Tatischeff will act as interpreter for the U.S. side and accompany the visitors during their entire visit.

December 7, Sunday :

Arrival by Aeroflot 313 from Moscow 6:30 pm.
Holiday Inn-LaGuardia Airport area. Alex Tatischeff will meet the flight.

December 8, Monday:

New York (La Guardia) - Boston AA384
Leave 8:30 am, arrive 9:23 am
Visit Manlabs, Dr. Larry Kaufmann will pick up at airport. 21 Erie Street, Cambridge, Mass. 02139 (617) 491-2900.

Boston-Cincinnati, American 453
Leave 5:40 pm, Arrive 8:45 pm.
Proceed by taxi to Quality Inn Central, 4147 Montgomery, Norwood, Ohio

December 9, Tuesday

Visit Metcut Research Associates.
Picked up at hotel by Dr. Michael Field, 3980 Rosslyn Drive, Cincinnati, Ohio 45909, (513) 271-5100

Cincinnati-Pittsburgh, TWA 532
Leave 1 pm, Arrive 1:50 pm
Proceed to Webster Hall Hotel.
Dr. Laughlin will meet party on arrival.

December 10, Wednesday

Visit Carnegie Mellon University, Dr. Dick Heckel and Dr. Lloyd Bauer, Schenley Park, Pittsburgh, PA 15213, (412) 828-5023.

December 11, Thursday

Visit Teledyne Firth Stirling, Dr. Law McCabe, 4 Parkway Center, Pittsburgh, PA 15220 (412) 922-9602

December 12, Friday

University of Pittsburgh, Dr. Hal Brody and Dr. G.H. Meier, 848 Benedum Hall, Pittsburgh, PA 15213 (412) 624-5302.

December 13, Saturday

Pittsburgh-Los Angeles, TWA 53
Leave 6:30 pm, Arrive 8:34 pm
Dr. Bunshah will meet the Flight.
Hotel Claremont, West Los Angeles

December 14, Sunday	Rest in Los Angeles
December 15, Monday	Visit Prof. Bunshah at UCLA, 6532 Boelter Hall, Los Angeles, CA 90024, (213) 825-2210 office, (213) 398-6506 home
December 16, Tuesday	Los Angeles-San Francisco, United 506 Leave 9 am, Arrive 10 am. Hilton Inn, San Francisco Airport. Visit Airco Temescal, Dr. Russel Hill 2850 Seventh, Berkeley, California (415) 841-5720
December 17, Wednesday	Picked up by Dr. Troy Barbee (1) Visit Industrial Vacuum Engineering, Dr. Hugh Smith, 307 North Amphlett Blvd., San Mateo, CA 94401 (415) 348-2866. (2) Visit Stanford University, Center for Materials Research, Stanford, CA 94305 Dr. Troy Barbee, Jr. (415) 497-2300 x 4118 (3) Dinner with Dr. Charles Hunt
December 18, Thursday	San Francisco-Portland, United 482 Leave 8:15 am, Arrive 9:45 am Dr. Erwin Rudy will meet the plane. Visit Dr. Erwin Rudy, Oregon Graduate Center, 19600 N.W. Wilke Road, Beaverton, Ore. 97005 (503) 645-1121. Possibly U.S. Bureau of Mines Hotel Mendel, Portland
December 19, Friday	Portland-New York (Kennedy), United 40 Leave 7:20 am, Arrive 4:40 pm Connect to Aeroflot to Moscow

FILE 57: ELECTROMETALLURGY

WORK PLAN
for US-USSR scientific-technical collaboration on
the theme "Solid State Joining"

				ORGANIZATIONS FROM	Start	End	Completion		
1	2	3	4	USSR	US	5	6	7	8

1. DIFFUSION WELDING

I. **Approved of the art review of solid state joining of similar and dissimilar metals and alloys for USA and USSR.**

1. Review and analysis of theories and hypotheses of the mechanism of joint formation in the diffusion joining of metals.
2. Review of the developments, applications, methods of intensification and apparatus of diffusion joining of similar and dissimilar metals in the US and USSR.
 - (a) US to review US work and literature
 - (b) USSR to review USSR work and literature
 - (c) review paper to be formed by combined surveys of US and USSR work and writing with a joint introduction and summary.

III. Development of techniques and methods for intensifying the joining of similar and dissimilar metals and alloys, in particular powders, by hot isostatic compaction.

1. Investigation of effect of load dynamics on intensification of the solid state joining of nickel
2. Investigation of effect of cyclic pressure on intensification of processes for joining nickel and titanium by quasi-static and dynamic loading.
3. Investigation of optimal conditions for joining titanium and its alloys by superplasticity.

Approved

**Jointly For
author of
paper**

Release 2001/08/27 : CIA-RDP79-00798A000300670006-2

**Single
author of
paper**

**Combined
review
paper**

Nov. 1975 Dec. 1977

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	1	2	3	4	5	6	7	8
4.	Development of techniques and methods to intensify processes of diffusion joining similar metals and dissimilar alloys, in particular, in combined processes of sintering and welding and use of ultrasonic oscillations (Ni to Ni, Al to Ti, Ti to Ti using Ni, Fe and Ti powders at the joint interfaces).	N.F. Kazakov, A.V. Sergeev, V.A. Bachin.	None	Nov. 1975	Dec. 1977	A paper and specimens		
5.	Investigation of the initial structure and loading effect on the process of a joint formation (Ni and Ti alloys).	E.S.Karakozov, A.P.Ternovskij, B.A. Molchanov Metallurgy Evening Institute, Moscow	None	"	"			
6.	To carry out methods to intensify welding by controlling welding parameters and structure changes in the welding zone (Ni and Ti alloys).	"	None	"	"			
7.	To carry out effective ways of control of quality of welded joints.	"	None	"	"			
8.	Investigation of the effect of the ways of surface preparation and the initial structure on the formation of the contact zone structure and properties of joints such as Ni with Ni, Ni-Cr alloy with Ni-Cr alloy (USSR), Co-alloy with stainless steel and Ni-alloy with W (US). Bond strengths will be determined.	L.I.Markashova, J.B.Malevsky	A.T.Male Westinghouse	Nov. 1975	Dec. 1977	A paper and exchange of specimens	000300070006-2	

	1	2	3	4	5	6	7	8
9.	Investigation of intensification methods for use in powder metal consolidation of Ni-base, Co-base, and Ti-base alloys; with associated reference to the effect of initial powder structure on the subsequent properties of the consolidated product.	None	A.T.Malle Westinghouse	Nov. 1975	Dec. 1977	A paper and specimens		
10.	Investigation of the method of pressure welding in vacuum using impact loading (for example, joining Ni with Ni, Fe with Nb, and Fe with Fe).	L.N.Larikov, V.M.Falchenko Institute of Physics of Metals. S.M.Gurevich, G.K.Harchenko Institute of Electro Welding.	None	"	"	"		
11.	Investigation of the mechanism to eliminate micro-defects by impulse loading (for example, joining Fe with Fe, Ni with Ni and Fe with Nb).	"	None	"	"	"		
12.	Determination of optimal limits of the deformation rate where abnormally high mass transfer is observed (for example, joining Fe with Fe, Ni with Ni and Fe with Nb).	"	None	Jan. 1977	Dec. 1977	"		
II.	Investigation of the kinetics of hetero-diffusion and formation of intermediate phases during the joining of dissimilar metals and alloys.	1. Development of analytic expressions and computer simulation methods for describing heterodiffusion and growth of intermediate phases in binary and ternary systems.	K.P.Gurov Baiakov Institute of Metallurgy, Moscow	J.I.Goldstein Lehigh University, USA.	Nov. 1975	Dec. 1977	Papers	

1	2	3	4	5	6	7	8
2.	Analytic investigation of heterodiffusion and growth process of joining dissimilar metals, forming diagrams of the eutectoid type.	K.P.Gurov Baikov Institute of Metallurgy, Moscow	K.P.Gurov M.Kh.Shorshorov, V.A.Antipov Baikov Inst. of Metallurgy, Ac.Sc., USSR.	None	Nov. 1975	Dec. 1977	Papers Approved For Release 2001/08/27 : CIA-RDP79-00798A000300070006-2
3.	General analytic investigation of heterodiffusion and growth of intermediate phases in the process of joining dissimilar metals by contact melting.	K.P.Gurov, M.Kh.Shorshorov, V.A.Antipov Baikov Inst. of Metallurgy, Ac.Sc., USSR.	J.I.Goldstein, M.R.Notis, P.Hilton Lehigh University, USA.	None	June 1976	Nov. 1977	"
4.	Experimental investigations of heterodiffusion process kinetics and formation of intermediate phases in binary (Fe-Al), (Al-Ti, Ni-Mo-USSR), and ternary systems (Fe-Ni-Al) during the process of diffusion joining (solid state) of dissimilar metals and alloys. Application of analytic and computer methods to this problem. Application of stress field models to the solid state joining process.	L.N.Larikov, V.M.Falchenko, V.M.Tishkevich, N.P.Kazakov, A.V.Sergeev, V.A.Bachin, V.P.Antonov	J.I.Goldstein, M.R.Notis, P.Hilton Lehigh University, USA.	Nov. 1975	Dec. 1977	Papers and exchange of specimens	CIA-RDP79-00798A000300070006-2
5.	Investigation of the use of various diffusion barriers in the production of composite specimens from the SiC/Ni alloy, SiC/Co alloy (USA), and SiC/Ti alloy specimens. Particular attention to be paid to the attainment of optimum strength properties.	M.Kh.Shorshorov	A.T.Male Westinghouse Electric, USA.	Nov. 1975	Dec. 1977	A Paper Approved For Release 2001/08/27 : CIA-RDP79-00798A000300070006-2	

	1	2	3	4	5	6	7	8
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IV. Mathematical simulation and calculation of the processes of formation of joints between dissimilar metals and alloys with emphasis on intermediate phases formation.	6.	Investigation of barrier effect of metallic interlayers on heterodiffusion between Fe-Al with a thin film interlayer of Ag.	L.N.Larikov, V.M.Falchenko, V.M.Tishkevich	J.I.Goldstein, M.R.Notis, P.Hilton	Nov. 1975	Dec. 1977	A paper and exchange of samples	Approved For Release 2001/08/27 : CIA-RDP79-00798A000300070006-2
	1.	Mathematical simulation of the formation stages for the physical contact and activation of contact surfaces in the process of joining dissimilar materials of strongly differing in resistance to deformation.	M.Kh.Shorshorov, V.P.Alekhin, Baikov Inst. of Metallurgy, Moscow	None	Oct. 1976	Nov. 1977	Papers	
	2.	Mathematical simulation of the growth of intermediate phases by heterodiffusion in the process of joining, and comparison to experimental data on systems such as the joining of Al to Ni.	K.P.Gurov, M.Kh.Shorshorov, V.I.Antipov A.F.Shelest	R.W.Heckel, R.F.Sekerka, C.L.Bauer	Nov. 1975	Dec. 1977	"	
	3.	To carry out a statistical model of physical contact formation by diffusion welding and matching of contact surfaces of similar metals and alloys.	E.S.Karakozov, J.V.Mjakishev, A.P.Ternovskij, B.A.Molchanov	None	"	"	"	
	4.	To carry out models for welding pressure due to thermal stresses, forming as a result of difference in coefficients of thermal expansion of materials being joined and devices.	"	None	"	"	"	
	5.	Mathematical simulation and calculation of processes of formation of a diffusion joint between dissimilar metals and alloys and intermediate phases. (Ni with Ni, Ni with Ti, and Al with Ti)	N.F.Kazakov, S.N.Golov	None	Nov. 1975	Dec. 1977	Papers	

1	2	3	4	5	6	7	8
6.	To develop quantitative models to describe the variation of stresses near an interface. Effects of thermal stresses and diffusion processes will be considered. Bulk specimens and thin film couples will be used to make experimental measurements (Fe-Ni-Al).	None	P.Hilton, M.R.Notis Lehigh University, USA.	Nov. 1975	Dec. 1977	Paper	"
1.	Investigation of the effects of residual stresses on the mechanical behavior of composites.	M.Kh.Shorshorov, L.M.Ustinov, V.V.Belov, Baikov Inst. of Metallurgy, Moscow	None	Nov. 1976	Nov. 1977	Paper	"
2.	COMPOSITE MATERIALS	M.Kh.Shorshorov, L.M.Ustinov, V.V.Belov	R.W.Heckel Carnegie-Mellon University, USA	Nov. 1975	Dec. 1977	Paper	"
1.	Investigation on models by means of holography of the stress field at the tip of a crack propagating from a barrier coating into a fibre taking into account residual stresses in the components of composite materials.	M.Kh.Shorshorov, L.M.Ustinov, V.V.Belov	R.W.Heckel Carnegie-Mellon University, USA	Nov. 1975	Dec. 1977	Paper	"
2.	Investigation of the development of residual stresses and their effect on strength of composite materials such as Al-B and Ni-W as a result of diffusional degradation (US) and such as Al-B, Al-stainless steel in the process of thermal cycling (USR).	M.Kh.Shorshorov, L.M.Ustinov, V.V.Belov	R.W.Heckel Carnegie-Mellon University, USA	Nov. 1975	Dec. 1977	Paper	"
3.	Investigation of residual stress effect on the mechanical properties of composite materials by diffusion welding (Cu and Mo, Cu and W, Al and Ti).	N.F.Kazakov, A.V.Sergeev, V.A.Bachin	N.F.Kazakov, A.V.Sergeev, V.A.Bachin	Jan. 1976	Dec. 1977	A Paper	"

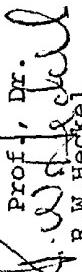
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4.	Development of mathematical models for residual stress effects relating to the mechanical behavior of composites.	None	I.J.Ebert Case-Western University USA	Nov. 1975	Dec. 1977	Papers	"
[II.]	Application of acoustic emission to the study of deformation and fracture of composites.	1. To carry out a dislocation model of acoustic emission to determine analytical dependence of AE parameters on the deformation parameters using data of tensile tests for monocrystals of B.C.C. metals and amplitude-frequency analysis of AE signals. 2. Investigation by means of AE of detailed mechanisms of deformation and fracture for composite materials (aluminum-boron fibres and steel wire - (USSR) and aluminum reinforced with stainless steel wire - (USA)).	M.Kh.Shorsharov, O.V.Gusev Baikov Inst. of Metallurgy, Moscow	None " " " "	Nov. 1975	Nov. 1976	"
			G.R.Speich U.S.Steel Research Laboratory	Nov. 1975	Dec. 1977		

Head of the theme "Solid State Joining" from the Soviet side
Prof. Dr.


M. Kh. Shorsharov

Head of the theme "Solid State Joining" from the USA side
Prof. Dr.


R.W. Heckel

November 21, 1975

Moscow

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4.	Development of techniques and methods to intensify processes of diffusion joining similar metals and dissimilar alloys, in particular, in combined processes of sintering and welding and use of ultrasonic oscillations (Ni to Ni, Al to Ti, Ti to Ti using Ni, Fe and Ti powders at the joint interfaces).	N.F. Kazakov, A.V. Sergeev, V.A. Bachin.	None	Nov. 1975	Dec. 1977	A paper and specimens	" "
5.	Investigation of the initial structure and loading effect on the process of a joint formation (Ni and Ti alloys).	E.S.Karakozov, A.P.Ternovskij, B.A. Molchanov Metallurgy Evening Institute, Moscow	None	" "	" "	" "	" "
6.	To carry out methods to intensify welding by controlling welding parameters and structure changes in the welding zone (Ni and Ti alloys).	"	None	" "	" "	" "	" "
7.	To carry out effective ways of control of quality of welded joints.	"	None	" "	" "	" "	" "
8.	Investigation of the effect of the ways of surface preparation and the initial structure on the formation of the contact zone structure and properties of joints such as Ni with Ni, Ni-Cr alloy with Ni-Cr alloy (USSR), Co-alloy with stainless steel and Ni-alloy with W (US). Bond strengths will be determined.	L.I.Markashova, J.B.Malevsky Westinghouse	A.T.Malq	Nov. 1975	Dec. 1977	A paper and exchange of specimens	" "

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9.	Investigation of intensification methods for use in powder metal consolidation of Ni-base, Co-base, and Ti-base alloys; with associated reference to the effect of initial powder structure on the subsequent properties of the consolidated product.	None	A.T.Male Westinghouse	Nov. 1975	Dec. 1977	A paper and specimens	
10.	Investigation of the method of pressure welding in vacuum using impact loading (for example, joining Ni with Ni, Fe with Nb, and Fe with Fe).	L.N.Larikov, V.M.Falchenko Institute of Physics of Metals.	S.M.Gurevich, G.K.Harchenko Institute of Electro Welding.	None	" "	" "	
11.	Investigation of the mechanism to eliminate micro-defects by impulse loading (for example, joining Fe with Fe, Ni with Ni and Fe with Nb).	"	None	" "	" "	" "	
12.	Determination of optimal limits of the deformation rate where abnormally high mass transfer is observed (for example, joining Fe with Fe, Ni with Ni and Fe with Nb).	"	None	Jan. 1977	Dec. 1977		
III	Investigation of the kinetics of hetero-diffusion and formation of intermediate phases during the joining of dissimilar metals and alloys.	1. Development of analytic expressions and computer simulation methods for describing heterodiffusion and growth of intermediate phases in binary and ternary systems.	K.P.Gurov Baikov Institute of Metallurgy, Moscow	J.I.Goldstein Lehigh University, USA.	Nov. 1975	Dec. 1977	Papers

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2.	Analytic investigation of heterodiffusion and growth process of joining dissimilar metals, forming diagrams of the eutectoid type.	K.P.Gurov, Baikov Institute of Metallurgy, Moscow	None	Nov. 1975	Dec. 1977	Papers	
3.	General analytic investigation of heterodiffusion and growth of intermediate phases in the process of joining dissimilar metals by contact melting.	K.P.Gurov; M.Kh.Shorshorov, V.A. Antipov Baikov Inst. of Metallurgy, Ac.Sc., USSR.	None	June 1976	Nov. 1977	"	
4.	Experimental investigations of heterodiffusion process kinetics and formation of intermediate phases in binary (Fe-Al), (Al-Ti), Ni-Mo-USSR), and ternary systems (Fe-Ni-Al) during the process of diffusion joining (solid state) of dissimilar metals and alloys. Application of analytic and computer methods to this problem. Application of stress field models to the solid state joining process.	L.N.Larikov, V.M.Falchenko, V.M.Tishkevich, N.F.Kazakov, A.V.Sergeev, V.A. Bachin, V.P. Antonov	J.I.Goldstein, M.R.Notis, P.Hilton Lehigh University, USA.	Nov. 1975	Dec. 1977	Papers and exchange of specimens	
5.	Investigation of the use of various diffusion barriers in the production of composite specimens from the SiC/Ni alloy, SiC/Co alloy (USA) and SiC/Ti alloy specimens. Particular attention to be paid to the attainment of optimum strength properties.	M.Kh.Shorshorov	A.T.Male Westinghouse Electric, USA.	Nov. 1975	Dec. 1977	A Paper	

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6. Investigation of barrier effect of metallic interlayers on heterodiffusion between Fe-Al with a thin film interlayer of Ag.

L.N.Larikov,
V.M.Falchenko,
V.M.Tishkevich
P.Hilton

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6. To develop quantitative models to describe the variation of stresses near an interface. Effects of thermal stresses and diffusion processes will be considered. Bulk specimens and thin film couples will be used to make experimental measurements (Fe-Ni-Al).

P.Hilton,
M.R.Notis
Lehigh University,
USA.

2. COMPOSITE MATERIALS

I. Investigation of the effects of residual stresses on the mechanical behavior of composites.

1. Investigation on models by means of holography of the stress field at the tip of a crack propagating from a barrier coating into a fibre taking into account residual stresses in the components of composite materials.
M.Kh.Shorshorov, L.M.Ustinov, V.V.Belov, Baikov Inst. of Metallurgy, Moscow
2. Investigation of the development of residual stresses and their effect on strength of composite materials such as Al-B and Ni-W as a result of diffusional degradation (US) and such as Al-B, Al-stainless steel in the process of thermal cycling (USSR).
M.Kh.Shorshorov, R.W.Heckel, Carnegie-Mellon University, USA
3. Investigation of residual stress effect on the mechanical properties of composite materials by diffusion welding (Cu and Mo, Cu and W, Al and Ti).
N.F.Kazakov, A.V.Sergeev, V.A.Bachin, Diffusion Welding Laboratory, Moscow

P.Papers
Nov. 1975 1977

P.Papers
Nov. 1976 1977

P.Papers
Nov. 1976 1977

P.Papers
Dec. 1976 1977

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4. Development of mathematical models for residual stress effects relating to the mechanical behavior of composites.

Application of acoustic emission to the study of deformation and fracture of composites.

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|---|---|---|---|---|---|---|---|---|
| None | | | | | | | | |
| L.J.Ebert
Case-Western
University
USA | | | | | | | | |
| M.Kh.Shorshorov,
O.V.Gusev
Baikov Inst. of
Metallurgy,
Moscow | | | | | | | | |
| " | | | | | | | | |
| G.R.Speich
U.S.Steel.
Research
Laboratory | | | | | | | | |
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1. To carry out a dislocation model of acoustic emission to determine analytical dependence of AE parameters on the deformation parameters using data of tensile tests for monocrystals of B.C.C. metals and amplitude-frequency analysis of AE signals.
 2. Investigation by means of AE of detailed mechanisms of deformation and fracture for composite materials (aluminum-boron fibres and steel wire - (USSR) and (aluminum reinforced with stainless steel wire - (USA)).

Head of the theme "Solid State Joining" from the Soviet side Prof., Dr. M.Kh.Shorshorov

Head of the theme "Solid State Joining" from the USA side Prof., Dr. R.W.Heckel

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